## VI. CLAIMS

1. A computer controlled and serviced intrusive plunger fruit tester, comprising in combination:

a frame having a base supporting laterally opposed upstanding sides interconnected by a top;

a centering plate, carried by the base between the sides, having means for centering a fruit supported thereon;

a powering train carried by the frame having a motor powering a motion translator for motion in a vertically orientated linear trajectory toward and away from the centering plate;

a plunger carried spacedly above the centering plate by a stress block depending from the motion translator for vertical motion toward and away from the centering plate responsive to motion of the motion translator;

a control member carried by the frame having

first means for powering the motor,

second means for sensing motor speed,

third means for controlling motor speed,

fourth means carried by the stress block for sensing pressure resisting plunger motion toward the centering plate, and

fifth means communicating with an associated

computer for transmitting and receiving digital computer data; and

an associated computer having software means for directing control member operation and for receiving, analyzing and displaying data received from the control member.

2. The fruit tester of Claim 1 further characterized by:

the means for centering and supporting the fruit on the centering plate comprising a conic indentation with apex lowermost defined in the surface of the centering plate proximal to the plunger and

the plunger comprising a vertically orientated circular cylinder having an axis aligned with the apex the conic indentation defined in the centering plate.

3. The fruit tester of Claim 1 further characterized by:

the centering plate carried in a testing chamber defined above the base and between the opposed sides with a rear shield carried by the opposed sides to enclose a rearward portion of the testing chamber and a front shield movably carried

by the opposed sides to selectively enclose a forward portion of the testing chamber and

a cover carried by the frame to enclose the fruit tester above the testing chamber.

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4. The fruit tester of Claim 1 further characterized by:

a stripper plate carried between the sides spacedly above the centering plate, said stripper plate defining an orifice for passage of the plunger therethrough but preventing passage of a fruit upwardly past the stipper plate.

5. The fruit tester of Claim 1 further characterized by:

the control member further including

battery powering means,

an optoelectric encoder to sense motor speed as a function of time to determine plunger position to at least 0.00003 inch,

at least one strain gauge carried by the stress block to determine pressure resisting plunger motion toward the centering plate to an accuracy of at least 0.016 pound, and

a motion controller for determining plunger trajectory responsive to software

commands provided by the associated computer responsive to data provided by the optoelectric encoder.

6. A computer controlled and serviced intrusive plunger type fruit tester, comprising in combination:

a frame having a base supporting laterally opposed upstanding sides having upper portions interconnected by a top;

a centering plate carried on the base and having an upper surface distal from the base defining a conic indentation with apex lowermost to center a fruit supported thereon;

a testing chamber defined above the base by a semi-cylindrical rear shield extending between the sides and a semi-cylindrical front shield pivotally carried by one side and extending to the other side to allow access to the testing chamber;

a stripper plate, carried between the sides in the testing chamber spacedly above the centering plate, said stripper plate defining an orifice to allow passage of a plunger therethrough and prevent the passage of a fruit upwardly above the stripper plate;

a cover enclosing the frame above the testing chamber;

a powering train supported by the frame and having a motor carried by the top communicating through a speed regulating transmission to drive a motion translator that moves a plunger slide body toward and away from the centering plate;

an elongate circularly cylindrical plunger carried by a stress block depending from structural interconnection with the plunger slide body, said plunger being spacedly distant from the centering plate and axially aligned with the apex of the conic indentation defined in the centering plate;

a control member carried by the frame and having

battery powering means,

an optoelectric encoder carried by the motor for sensing and transmitting motor speed data,

a motor controller for determining motor speed responsive to software commands generated responsively to historical motor speed data, and

a plurality of strain gauges

spacedly carried by the stress block and electrically interconnected in a bridge circuit to sense and transmit data indicating pressure resisting plunger motion toward the centering plate; and

an associated computer having software means for transmitting data to the control member and for receiving, analyzing, displaying and storing data received from the control member.

7. A method for determining the maturation state and condition of a fruit with a computer serviced intrusion type plunger tester, comprising the steps of:

mechanically moving an elongate plunger into the fruit through a plurality of spaced data points within the fruit and determining plunger position relative to the fruit surface at at least some of the data points;

determining pressure resisting plunger penetration into the fruit at least one data point within the fruit;

analyzing the pressure resisting plunger penetration into the fruit at the at least one data point by comparing that pressure data with a

predetermined profile of similar analyses of similar fruit of predetermined condition and maturation state to determine the condition and maturation state of the tested fruit.

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8. The process of Claim 7 further including the step of:

moving the plunger into the fruit at a constant predetermined velocity and measuring the pressure resisting plunger penetration into the fruit at at least some of the spaced data points.

9. The process of Claim 7 including the step of:

maintaining the plunger in the fruit at a predetermined constant pressure at at least one predetermined data point and measuring plunger motion over a predetermined period of time at the at least one predetermined data point.

10. The process of Claim 7 further including the steps of:

sequentially moving the plunger into the fruit at predetermined constant velocity and maintaining the plunger in the fruit under predetermined constant pressure for at least one predetermined period of time; and

determining both force resisting plunger penetration and distance of plunger motion under constant pressure at at least some of the spaced data points.

11. The method of Claim 7 further including the steps of:

classifying an apple into three concentric zones comprising an R-1 zone extending from the fruit peripheral surface radially inwardly to a depth of substantially 0.320 inch, an R-2 zone extending radially inwardly from the R-1 zone to an R-3 zone and R-3 zone comprising the core area;

determining plunger position and pressure resisting plunger penetration into the fruit at at least one data point in each of the three concentric zones; and

analyzing the pressure resisting plunger penetration in each of the three zones to determine fruit condition and maturation state by comparing the pressure data in each zone to similar data obtained from fruit of the same type and of predetermined condition and maturation state to determine the condition and maturation state of the tested fruit.

12. The method of Claim 7 further including the steps of:

classifying an apple into three concentric zones comprising an R-1 zone extending from the fruit peripheral surface radially inwardly to a depth of substantially 0.320 inch, an R-2 zone extending radially inwardly from the R-1 zone to an R-3 zone and an R-3 zone comprising the core area;

determining initial plunger position and plunger motion therefrom at a predetermined constant plunger pressure over a predetermined period of time at at least one data point in each of the three concentric zones; and

analyzing the plunger motion in each of the three zones to determine the fruit condition and maturation state by comparing the motion data to similar data obtained from fruit of the same type and of predetermined condition and maturation state.

13. The method of Claim 7 further including the steps of:

classifying an apple into three concentric zones comprising an R-1 zone extending from the fruit peripheral surface radially inwardly to a

depth of substantially 0.320 inch, an R-2 zone extending radially inwardly from the R-1 zone to an R-3 zone and an R-3 zone comprising the core area;

determining plunger position and sequentially moving the plunger into the fruit at a predetermined constant velocity to determine pressure resisting plunger penetration and maintaining the plunger in the fruit under predetermined constant pressure for predetermined periods of time to determine plunger penetration under constant pressure at at least one data point in each of the three concentric zones; and

analyzing the pressure resisting plunger penetration and the plunger motion under constant load in each zone to determine fruit condition and maturation state by comparing the plunger pressure data and motion data in each zone to similar data obtained from fruit of predetermined condition and maturation state.

14. The method of Claim 13 further including the step of:

determining a quality factor comprising a numerical value representing fruit condition by combining numerical values of pressure resisting

plunger penetration at a predetermined constant plunger velocity and plunger penetration over a predetermined time at a constant plunger pressure as determined in all three concentric zones of the fruit.

15. The method of Claim 13 further including the step of:

determining the quality factor by combining the numerical data in each of the three concentric zones of the fruit by averaging the numerical data from each zone, weighting the average of the data from at least one zone and adding the resultant averages for each zone.

16. The process of Claim 7 further includes the step of:

measuring frequency dependent pressure resisting plunger penetration at constant plunger velocity over a predetermined sequence of data points; and

analyzing the numeric values of frequency dependent pressure variations at sequential data points through finite Fourier transformation to derive a numeric measure representing fruit maturity and condition

from the frequency dependent pressure values for comparison with similar values derived from fruit of the same type and of predetermined condition and maturation state to determine the condition and maturation state of the tested fruit.

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17. The process of Claim 10 further including the steps of:

maintaining the plunger in the fruit at at least one data point in the R-1 zone and one data point in the R-2 zone, said data points being spacedly adjacent to each other and on opposite sides of the boundary between the R-1 zone and the R-2 zone, for predetermined periods of time and measuring plunger motion over the predetermined periods of time.